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King Abdullah University of Science and Technology
Thuwal, Kingdom of Saudi Arabia

The المنارة Beacon

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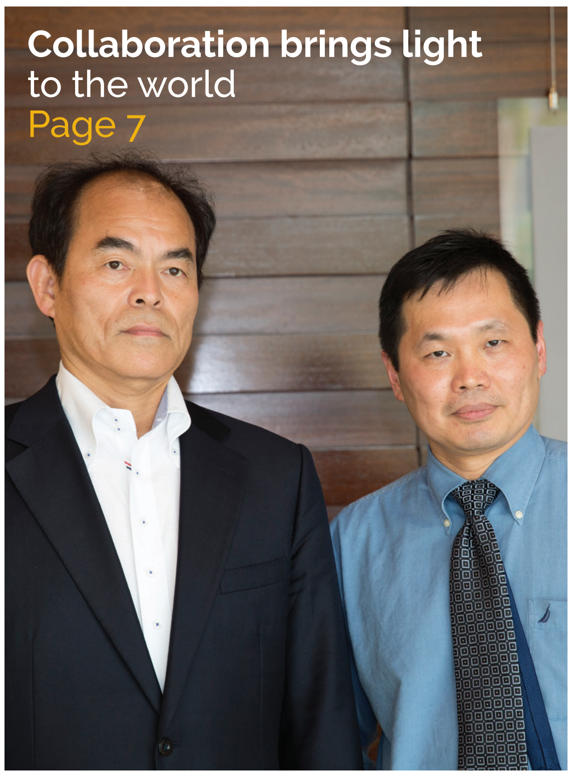
ظهور جزر بركانية
جديدة في البحر الأحمر

New islands emerge in the Red Sea Page 4



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In brief

On **Thursday, June 4, Nobel laureate Shuji Nakamura** gave a talk on the history and background of his invention of high-brightness blue light-emitting diodes (LEDs). Nakamura's invention has the potential to **save up to 20% of global electricity** consumption. For more information, see page 6.

On **Thursday, June 11,** a team from IBM visited the campus to present a seminar on cloud technologies. Lecture Hall 2 in the Engineering Science Hall was at capacity as faculty, staff and students engaged in a collaborative discussion about the benefits of cloud computing.

On **Wednesday, June 17**, Saudi Aramco's Chief Technology Officer Ahmad Al-Khowaiter gave a lecture and took part in a Q&A session for KAUST's 2015 Saudi Research Science Institute (SRSI) students and the wider University community.

The **annual KAUST Community Iftar** was held on **Wednesday, July 1.** Over 1200 community members are estimated to have attended the event, which was held along the Discovery Walk outside the University Library.

KAUST Medical Center hosted a **Ramadan night event on Thursday, July 2** in the Discovery Cinema lobby. The event featured complimentary health screenings, one-on-one counseling by KMC physicians, giveaways and a discounted rate on fresh meals prepared by Tamimi.

Shaheen XC40, KAUST's new Cray system, is the **seventh fastest supercomputer** in the world according to the TOP500 list announced on July 13 at the International Supercomputing Conference in Frankfurt, Germany.

Orientation 2015 will be held from **Sunday, August 9 to Saturday, August 22.** The orientation program will include cultural and academic onboarding events, including the **Orientation Expo & Bazaar**, which will be held on **Thursday, August 20.** This event will feature over 50 booths from service providers, retail outlets, graduate student groups, on-campus associations and more. Visit **thelens.kaust.edu.sa** for more information.

The Fourth Annual **Thuwal and Qadimah School Kit Fundraiser** is accepting support from community members through **Sunday, August 2.** To assist, you can buy a voucher at on-campus Tamimi stores, Matjar or the Campus Diner. KAUST will match all contributions to the fundraiser this year. You can also volunteer to pack and deliver bags to the local children. For more information, visit **thelens.kaust.edu.sa**.

TKS classes will reopen on Tuesday, August 25. If you have any questions, please call the TKS helpdesk at 808-6320, or email schools@kaust.edu.sa.

On **November 2**, a group of investors called the **Arabian Techtour** will visit KAUST. More than **80 international investors and over 100 VIPs** from Saudi Arabia will be on hand to assess venture capital opportunities and become better acquainted with the innovation ecosystem on campus.

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First alumni **chapter established outside KSA**

The KAUST China Alumni Chapter has been set up, representing another great achievement for the University. The chapter is the first international alumni group to be established and follows the successful formation of the Saudi Arabia Alumni Chapter in 2014.

The China Alumni Executive Committee Members are:

- President, Xiao Bingmu, M.S. 2013; current employer: CGG
- President Elect, Ren Yi, M.S. 2011; current employer: Sinopec
- Vice President for Programs, Li Cen, M.S. 2011; current employer: Chemchina Corp
- Vice President for Communication, Wang Hao, M.S. 2013; current employer: China United Engineering Corporation
- Treasurer, Ding Ruogu, M.S. 2012; current employer: Semidata

KAUST is delighted with this new initiative and wishes the chapter's executive committee and all China Alumni Chapter members great success in this endeavor. If you wish to know more about the chapter, or to contact the executive committee members, please send an email to Alumni.Services@kaust.edu.sa. ●

Cover: KAUST researchers use satellite images and seismic data to investigate newly formed islands in the Red Sea off the coast of Yemen. Read more in this month's cover story on page 4.

Cover Bottom Left: KAUST Professor of Electrical Engineering Boon Ooi (right) and Nobel Laureate and UCSB Professor of Engineering Shuji Nakamura at a recent event on KAUST campus. The two researchers are working together to provide energy-efficient lighting to the world. Read more on page 6.

Accolades

KAUST alumna wins prestigious fellowship

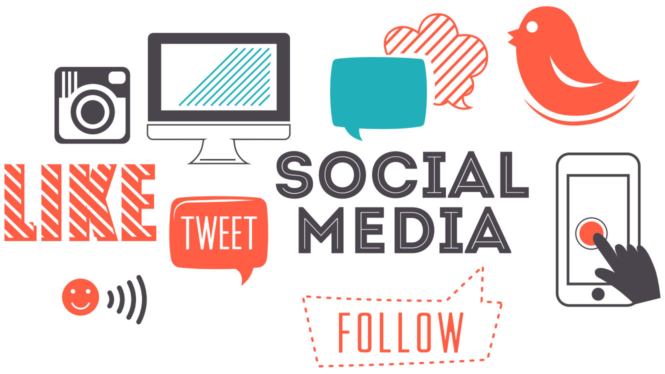
1

Former KAUST postdoctoral fellow and Newcastle University Research Associate Dr. Paola Crippa was awarded a L'Oréal-UNESCO U.K. & Ireland Fellowship For Women in Science on June 23 in a ceremony at London's Royal Society. At KAUST, she was mentored jointly by Professor of Applied Mathematics and Computational Science Marc Genton and Professor of Earth Science and Engineering Georgiy Stenchikov.

Crippa was recognized for her work entitled "Modelling particulate matter pollution from vegetation fires in South-East Asia." She has proposed using the fellowship funds to integrate model results with satellite data to more accurately predict population exposure to harmful concentrations of particulate matter.

Her research will be the first time high-resolution simulations from a state-of-the-art regional atmospheric chemistry model are used to capture both urban and regional scale air pollution features. "Results from my research will help to plan for strategies to mitigate impacts on human health in densely populated areas affected by vegetation fires," Crippa said.

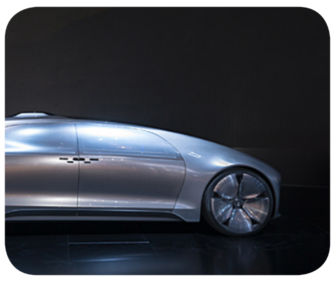
Crippa was one of five winners selected by a jury of eminent scientists chaired by Professor Pratibha Gai, L'Oréal's 2013 International Laureate. The fellowships promote and reward outstanding female postdoctoral researchers and offer flexible financial help worth £15,000. ●



Here's a roundup of KAUSTcontent from around the web.

Learn about Red Sea Gliders from Professor Burt Jones.
https://goo.gl/cVUnlS

See how funding from KAUST is helping to bring innovative solar power technology to fruition with the startup company QD Solar.
http://goo.gl/H4vyKK



Read about how KAUST Electrical Engineering Assistant Professor Bernard Ghanem is teaching computers to "see" the world.
http://goo.gl/SVfn6P ●

New islands emerge in the Red Sea

Between 2011 and 2013, two volcanic islands appeared in the Zubair archipelago's mid-ocean ridge system. The eruptions from which they were formed were accompanied by a series of earthquakes, and the seismic and volcanic activity caused visible disturbance to the landscape on neighboring islands.

Associate Professor of Earth Science and Engineering Sigurjón Jónsson recalled hearing of the islands' formation in December 2011, along with his colleagues, doctoral student Wenbin Xu and postdoctoral fellow Joel Ruch.

"Given the rarity of such an event, we immediately wanted to learn from it," Jónsson said. "However, the islands belong to Yemen and are basically out of reach for fieldwork, so our observations were limited to satellite images and seismic data."

Xu and Ruch used high-resolution satellite optical and radar-imaging techniques to study both how the islands developed as well as how the land deformed on other islands in the archipelago. They detected a previously unrecognized yet significant period of magmatic activity connected with the separation of the African and Arabian continental plates.

Xu used this information to simulate the two eruptions and pinpoint the likely underground triggers for the volcanic activity. Each eruption was fed by a dike—an intrusion of magma pushing towards the surface through existing rock layers. The model suggests both dikes run along a larger, existing North-South fracture system, which cuts through the Zubair area.

"We realized the two eruptions were likely part of a larger sequence of events — a so-called rifting episode," explained Jónsson. "Rifting episodes occur on boundaries where continental plates are moving apart—a large amount of magma enters the crust from below, and meter-scale spreading of the plates can occur in just a few years. More often than not this happens on the sea floor where it's almost impossible to study."

Many decades of limited activity can pass between rifting episodes in any one particular place—the last period of rifting in the southern Red Sea was probably in the 19th century. The recent events present a valuable opportunity to advance understanding of plate divergence, particularly as they are visible on the Earth's surface.

"We will continue studying this island-building event and its possible influences on future activity in the area," said Jónsson. ●

ظهور جزر بركانية جديدة في البحر الأحمر

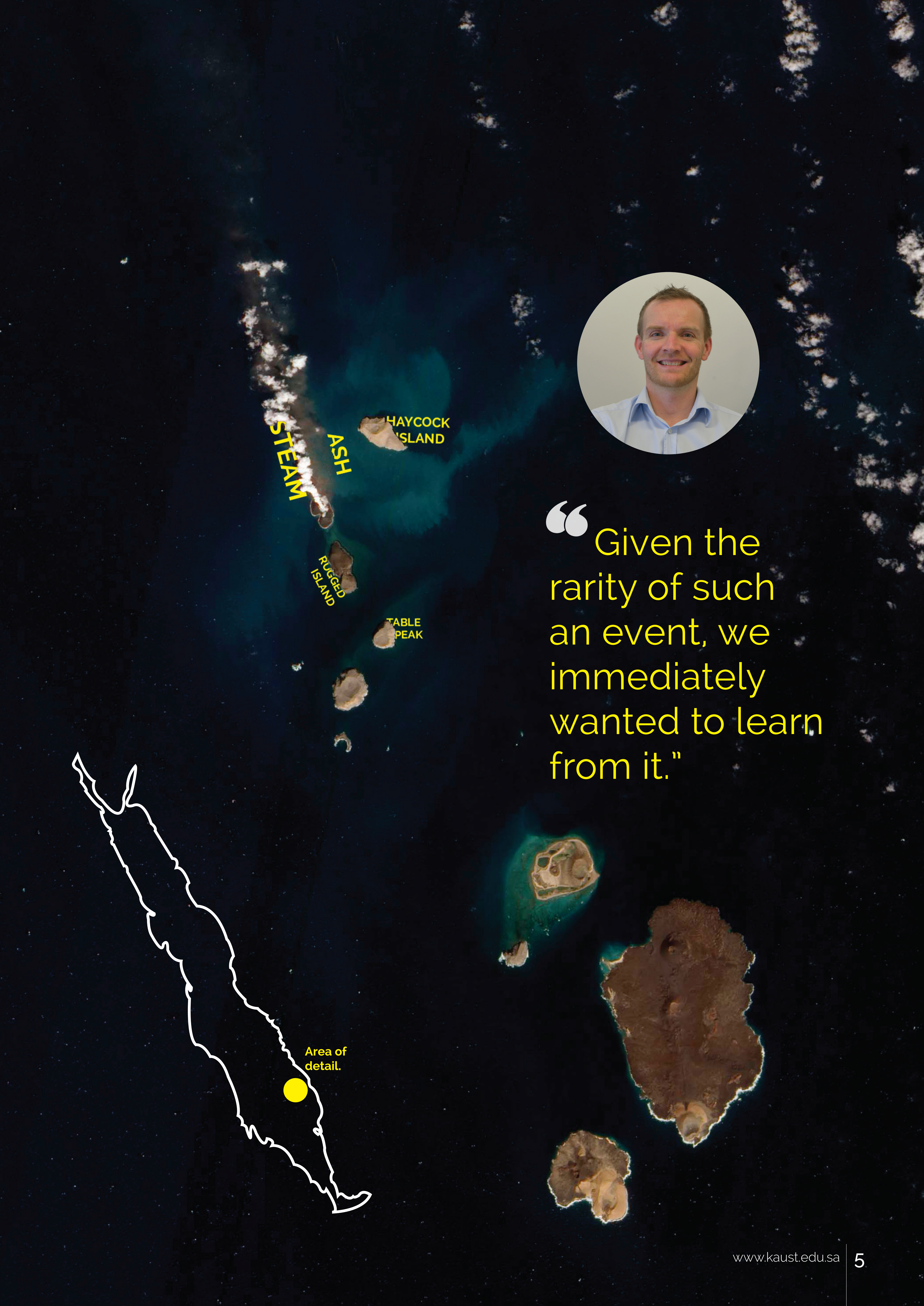
ظهرت في البحر الأحمر جزيرتان جديدتان بالقرب من أرخبيل الزبير قبالة الساحل اليمني التي تشتهر بنشاطها البركاني المصحوب بسلسلة من الزلازل وتصاعد الدخان من البحر. وكانت ولادة هذه الجزر الجديدة دافعا كبير للبروفيسور سيجورن يونسون وزملائه وينبن شو وجويل روش من برنامج هندسة وعلوم الأرض في جامعة الملك عبدالله ليقوموا بدراسة هذه الظاهرة الفريدة التي سمعوا عنها أول مرة في شهر ديسمبر عام 2011، حيث قال البروفيسور يونسون: "أردنا دراسة هذه الظاهرة النادرة جداً والتعلم منها ولكن نظراً لصعوبة القيام بالعمل الميداني في هذه الجزر، اقتصرت دراساتنا على صور الأقمار الصناعية والبيانات السيزمية."

واستعان الباحثان شو وروش بتقنيات صور الرادار والأقمار الصناعية عالية الدقة لدراسة كيفية تطور هذه الجزر وآثار تشكّلها على القشرة الأرضية للجزر الأخرى في المنطقة وتمكنا من ربط هذه الظاهرة بفترة غير محددة من النشاط البركاني رافقت عملية انفصال الصفائح القارية الأفريقية والعربية.

ويستخدم شو هذه المعلومات لمحاكاة ثورانين بركانيين تحت الأرض وتحديد مسبباتها. وأظهرت نتائج هذه المحاكاة ارتباط كل ثَوَران بما يسمى جيولوجيا بالجيب النافذ (dike): وهو نفوذ حمم الصهارة خلال شقوق موجودة في طبقة صخرية أقدم منها. وتقترح نتائج هذه المحاكاة أن هذه الجيوب النافذة تمتد على طول صدع كبير شمالي - جنوبي يتقاطع مع أرخبيل الزبير.

ويوضح البروفيسور يونسون: "نعتقد أن الثورانين هما بداية محتملة لسلسلة أكبر من الظواهر الطبيعية تسمى حلقة التصدع التي تحدث على حدود الصفائح القارية المتباعدة - حيث تنفذ كمية كبيرة من المواد المنصهرة القادمة من الطبقات السفلية إلى القشرة الأرضية، مما ينتج عنه تباعد للصفيحة القارية بنطاق أمتار خلال بضع سنوات. وتحدث هذه الظاهرة في الغالب في أعماق سحيقة في البحر الأمر الذي يحد من فرصة دراستها بصورة مفصلة."

وكان آخر نشاط بركاني مسجل في حلقة التصدع في القشرة الأرضية للمنطقة الجنوبية من البحر الأحمر في القرن التاسع عشر. لذلك تعتبر الأنشطة البركانية التي حدثت أخيراً في البحر الأحمر فرصة ثمينة لفهم ظاهرة تحرك الصفائح القارية على نحو أوسع لا سيما تلك التي تكون تأثيراتها واضحة بالعين المجردة. ويؤكد البروفيسور سيجورن يونسون أنه مع فريقه في جامعة الملك عبدالله سيواصلون دراسة ظاهرة تكون هذه الجزر وتأثيراتها المحتملة على الأحداث البيئية المستقبلية في المنطقة.



> “Given the rarity of such an event, we immediately wanted to learn from it.”

> “Through KAUST and UCSB's complementary expertise in laser-based SSL, many interesting outcomes are sure to result”

Collaboration brings light to the world

By Caitlin Clark

KAUST Professor of Electrical Engineering Boon Ooi, Nobel laureate and University of California, Santa Barbara (UCSB) Professor of Engineering Shuji Nakamura and a team of researchers from King Abdulaziz City of Science and Technology (KACST) are working to provide energy-efficient lighting to the world.

Through a tripartite agreement begun in 2014, the team works on the development of laser-based solid-state lighting (SSL), a type of lighting that may save even more energy than currently used light-emitting diode (LED) lighting.

"Through KAUST and UCSB's complementary expertise in laser-based SSL, many interesting outcomes are sure to result," Nakamura said.

Solid-state lighting and energy efficiency

SSL is a term that broadly refers to semiconductor materials used to convert electricity into light. LEDs—the dominant type of SSL—consist of layers of semiconductor materials that emit light through a process called spontaneous emission.

LEDs are more energy-efficient than traditional bulbs, such as incandescent and halogen bulbs, because they convert a much larger percentage of the electrical energy put into them into light.

"Over 40 percent of the electrical energy going into an LED-based SSL device is converted into visible light," Ooi explained. "In comparison, a regular incandescent bulb converts only about 3 percent of the energy into light and the rest into heat. In addition, SSL has a much longer lifespan than traditional lighting, ranging up to 50,000 hours or more for LEDs."

Blue LEDs and the Nobel Prize

In 2014, Nakamura, Isamu Akasaki and Hiroshi Amano were awarded the Nobel Prize in Physics for their work in developing blue LEDs, which have been essential in enabling the creation of white LED lights suitable for widespread use. LEDs are not inherently white light-producing devices, and white light production requires either the use of a blue LED to excite yellow phosphor, or a combination of red, green and blue LED lights.

Although red and non-visible near infrared diodes existed, it was much more challenging to create blue ones. Nakamura and his colleagues produced blue LEDs through the use of the semiconductor gallium nitride (GaN), a material that was notoriously difficult to handle at that time.

The future is bright

LEDs are now used in parking lots, supermarkets, homes, hotels, office buildings and museums, in devices such as flashlights, in signage and more. There are, however, some disadvantages to LEDs: for example, they become less efficient above a certain electrical current.

"LED lighting is now moving to the next stage, and we believe this may be semiconductor laser-based SSL," Ooi said. "In comparison to LEDs, laser diodes are brighter, they operate at higher optical output power and they have much higher power efficiencies with comparable cost to LEDs."

In the current collaboration, the KAUST team works on designing different material structures to produce high performance semiconductor lasers.

"We have to design the light emitting layer we call the active layer," Ooi explained. "Nakamura and his lab grow the laser material structures out of high-quality GaN and its related materials according to our design.

"Here at KAUST, we then apply nanofabrication techniques on the laser wafer grown at UCSB to convert it into semiconductor laser devices. We also carry out the necessary characterization steps at KAUST and bring the device to the system level applications."

Other uses for semiconductor lasers

Nakamura, Ooi and the team are also excited about their work with semiconductor lasers because of the lasers' "other advantages and side applications," noted Ooi. Among these are the use of lasers for visible light and underwater communications and using them to grow indoor plants with red and blue colored lights, thereby saving energy, water and space.

"KAUST and UCSB have already demonstrated that GaN-based lasers can be used to transmit Internet signals with 100 times more data than the present microwave transmission technology," Nakamura said.

Saving energy for the world

Ooi hopes that laser-based SSL "will one day replace most of the world's power-hungry bulbs. I think that LED-based bulbs have another 10-20 years to go, but if LEDs are replaced by semiconductor laser-based bulbs, we will save even more energy."

Even if the use of semiconductor lasers is not eventually accepted for SSL, Ooi noted, the lasers' other applications make them promising. "We call these lasers a solution looking for a problem—people just have to think about how to use them," he said.

"I enjoy the collaboration with Nakamura and his group at UCSB not because I'm working with a Nobel laureate, but because of the science," Ooi said. "We have a lot of interesting science we work on together, and through our experimental work, we are beginning to see a lot of results, so it has become quite a fruitful collaboration." ●

Innovation Fund provides **funding for tech-based startups**

By David Murphy

The KAUST Innovation Fund, formerly known as the Seed Fund, supports the University's pipeline of technology-based startup projects and companies. It also invests in high-profile international technology companies willing to establish their operations in Saudi Arabia and to benefit from synergies with KAUST research activities. The new fund is one of the very few players in Saudi Arabia making venture capital investments in technology-based startups from seed (less than $200,000) to early-stage (up to $2 million).

KAUST has taken a bold stance in contributing to the emerging venture investing ecosystem in Saudi Arabia and is actively supporting KAUST-based startups and high-profile early stage companies willing to move to the Kingdom. The Innovation Fund is currently managing a portfolio of more than 15 startups and has adopted a hands-on approach to ensure their success. The new Fund intends not only to provide the financial resources needed by a startup to grow, but also aims to be a long-term strategic partner providing operational support.

"This approach is quite novel in academic institutions and is the first of its kind in Saudi Arabia," said Nicola Bettio, the manager of the KAUST Innovation Fund. "We need to support the growth of our startups beyond simple seed funding, encourage international technology-based early stage companies to move to Saudi Arabia and attract local investors and international venture capitalists to the Kingdom's relatively young innovation ecosystem."

The core difference from the previous Seed Fund program is that the funds provided by KAUST will now allow the University to become shareholder of the startup once its incorporation process is completed. Moreover, applications for seed funding can now be submitted at any time; there is no more need to wait for the next seed fund round.

Additionally, the Innovation Fund is working with more mature startups needing to finance further stages of their growth, in order to raise larger investment rounds in partnership with financial and industrial co-investors in Saudi Arabia and the region.

What makes a startup's business a good candidate for investment?

The most important factors in determining whether the KAUST Innovation Fund will invest in a startup includes a large potential market, a superior product/technology, a strong team and a clear business plan. The Fund also assess the extent to which the startup's technology is aligned with KAUST's main research areas and its potential impact on the region in terms of job creation and solutions to specific local problems.

The Fund's main investments focus on:

- **KAUST internal startup projects** - teams working on entrepreneurial projects related to KAUST areas of excellence.
- **KAUST early-stage companies** - KAUST startup projects that have gone through the incorporation process and need additional funding.
- **Spin-ins** - International early-stage technology companies that are interested in establishing R&D activities at KAUST.

How and when to submit a business plan?

If you have a breakthrough technology, a strong team and clear business model for a new startup that you would like to be considered for funding, the first thing you must do is to draft a business plan and send it to the Innovation Fund (KIF@kaust.edu.sa).

To create the most complete, coherent and compelling business plan, we recommend participating in the startup training sessions or acceleration programs offered by the KAUST Entrepreneurship Center (contact entrepreneurship@kaust.edu.sa).

Before making any public disclosure or communication of your innovation, we encourage you to talk with the KAUST Technology Transfer Office to disclose and protect your inventions (contact ip@kaust.edu.sa). ●

1. Innovation Fund Manager, Nicola Bettio outlines how KAUST is helping fuel startups, early-stage companies and more.

صندوق دعم الابتكار التابع لجامعة الملك عبدالله للعلوم والتقنية **يمول شركات التقنية الناشئة**

صندوق دعم الابتكار التابع لجامعة الملك عبدالله للعلوم والتقنية - والمعروف سابقاً باسم صندوق التمويل الرئيسي - يقدم الدعم للمشاريع والشركات الناشئة القائمة على التقنية والتي تتبناها الجامعة. كما يستثمر في شركات التقنية العالمية البارزة، الراغبة في تأسيس أعمالها في المملكة، والاستفادة من سبل التعاون مع الأنشطة البحثية في الجامعة. ويعدّ الصندوق الجديد أحد الصناديق الاستثمارية القليلة في المملكة التي تستخدم استثمارات رأس المال في الشركات الناشئة التي تقوم على التقنية (أقل من 200,000 دولار) للمرحلة المبكرة (إلى مليوني دولار).

وقد اتخذت جامعة الملك عبدالله موقفاً رائداً ومميزاً في مجال تحفيز مناخ الاستثمار في الشركات الجديدة والناشئة في المملكة العربية السعودية، وذلك من خلال الدعم الفعال الذي تقدمه إلى الشركات الناشئة التي تتبناها، كذلك الشركات رفيعة المستوى في مراحلها المبكرة والراغبة في الانتقال إلى المملكة. حالياً يقوم صندوق دعم الابتكار بإدارة مجموعة مكونة من خمس عشرة شركة ناشئة، كما يسلك نهج التدريب العملي لضمان نجاح تلك الشركات. ويسعى الصندوق الجديد ليس فقط إلى توفير الموارد المالية اللازمة لنمو الشركات الناشئة، بل ليكون شريكاً استراتيجياً طويل المدى يوفر الدعم التشغيلي.

ويقول نيكولا بيتيو مدير صندوق دعم الابتكار في جامعة الملك عبدالله "هذا النهج يعدّ جديداً تماماً في المؤسسات الأكاديمية، وهو الأول من نوعه في المملكة العربية السعودية، حيث إننا بحاجة إلى تشجيع نمو الشركات الناشئة بصورة أبعد من مجرد الدعم البسيط الذي يقدمه صندوق التمويل التأسيسي، وكذلك تشجيع الشركات الدولية رفيعة المستوى القائمة على التقنية والتي هي في مراحلها المبكرة للانتقال إلى المملكة العربية السعودية. وجذب المستثمرين المحليين، وأصحاب رؤوس الأموال الدولية لتشجيع مناخ دعم الابتكار الناشئ نسبياً في المملكة."

ويكمن الاختلاف الجوهري عن برنامج صندوق البذور السابق في كون الدعم الذي تقدمه الجامعة حالياً سوف يسمح لها أن تكون مساهماً في تلك الشركات الناشئة بمجرد إتمام عملية التأسيس. فضلاً عن أنه أصبح الآن من الممكن اعتماد طلبات الحصول على دعم من الصندوق في أي وقت، ولم يعد هناك حاجة إلى انتظار دورة صندوق التمويل التأسيسي. بالإضافة إلى ذلك، فإن صندوق دعم الابتكار يعمل مع شركات ناشئة أكثر نضجاً تحتاج لتمويل المراحل المقبلة من نموها، وذلك بهدف زيادة الجولات الاستثمارية بصورة أكبر بالشراكة مع مستثمرين مشاركين في المجال المالي والصناعي من المملكة العربية السعودية والمنطقة..

ما العوامل التي تجعل من شركة عمل ناشئة مرشحاً جيداً للاستثمار؟

إن أهم العوامل التي من شأنها أن تحدد ما إذا كان صندوق دعم الابتكار التابع لجامعة الملك عبدالله للعلوم والتقنية سوف يقوم بتمويل أحد الشركات الناشئة من عدمه، تتضمن الآتي: وجود سوق محتملة كبيرة، منتج/تقنية متفوقة، فريقاً قوياً، وخطة عمل واضحة. كذلك يقوم الصندوق بتقييم مدى توافق التقنية التي تعتمد عليها الشركة الناشئة مع مجالات البحث الرئيسة في الجامعة، كذلك التأثير المحتمل على المنطقة من حيث توفير فرص العمل وإيجاد حلول للمشاكل والتحديات المحلية.

وتركز الاستثمارات الرئيسية للصندوق على:

- المشروعات الداخلية الناشئة التابعة لجامعة الملك عبدالله للعلوم والتقنية - فرق العمل في مشاريع ريادية متصلة بمجالات أبحاث الجامعة.
- الشركات في مرحلة مبكرة تابعة أيضاً لجامعة الملك عبدالله ـ المشروعات الناشئة في الجامعة والتي تم تأسيسها وما تزال بحاجة إلى تمويل إضافي.
- الشركات المستقلة - الشركات الدولية رفيعة المستوى القائمة على التقنية والتي هي في مراحلها المبكرة وتهتم بتأسيس أنشطة تعليمية وتطويرية R&D في جامعة الملك عبدالله.

كيف ومتى يتم اعتماد خطة العمل؟

إذا كان لديك فكرة تقنية فائقة، وفريقاً قوياً، ونموذج عمل واضح لمشروع جديد ناشئ ترغب في أن تحصل له على تمويل، فإن أول شيء عليك القيام به هو وضع خطة عمل وإرسالها إلى صندوق دعم الابتكار (KIF@kaust.edu.sa).

ومن أجل وضع خطة عمل قوية ومتماسكة ومقنعة، نقترح عليك المشاركة في دورات تدريبية لتأسيس المشروعات الناشئة، أو برامج التسريع المقدمة من مركز ريادة الاعمال التابع لجامعة الملك عبدالله للعلوم والتقنية، للتواصل على البريد الإلكتروني entrepreneurship@kaust.edu.sa

كما يمكنك التواصل مع مكتب نقل التقنية التابع للجامعة للإفصاح عن وحماية ابتكارك قبل أي كشف علني له من خلال البريد الالكتروني ip@kaust.edu.sa

Illuminating the structure of the human ‘diseasome’

By Caitlin Clark

In recent years, scientists have made great progress in understanding both the genetic and molecular mechanisms underlying disease, and in particular those for rare and inherited diseases. These advances have been facilitated by new technologies such as next generation sequencing.

Understanding common, infectious and environmentally based diseases, however, has proved more difficult, as external factors are involved and the complexity of genetic predisposition to common diseases has made identifying the underlying genes and pathways challenging.

In a study published in Scientific Reports, KAUST Assistant Professor of computer science Robert Hoehndorf, University of Cambridge Reader in Biomedical Informatics Paul Schofield and Aberystwyth University Reader in Bioinformatics Georgios Gkoutos developed a semantic text-mining approach to use the phenotypes, or signs and symptoms, associated with rare and common diseases to establish the phenotypic similarity of over 6,000 diseases.

The work unifies rare, common and infectious diseases for the first time at scale and provides “a tantalizing overview of the phenotypic structure of the human ‘diseasome,’” Hoehndorf said.

Researchers have long been cataloguing phenotypic data relating to genetically based diseases, and now catalog it in electronic resources, such as the Online Mendelian Inheritance in Man (OMIM) and Orphanet databases. Although these databases are very useful for Mendelian genetic diseases, extending similar methods to common and infectious diseases has proved challenging due to the lack of an infrastructure providing the huge number of phenotypes associated with these diseases.

“To take on this task, we needed very large computational capacity,” Hoehndorf explained. “Using semantic technologies exploiting special structured terminologies called ontologies, we captured all of the required information from millions of published papers and abstracts to establish the similarity between a large number of common and rare diseases.”

Hoehndorf and the team’s method of grouping diseases allows for new approaches to identify the genes and pathways that underlie clusters of phenotypically similar diseases.

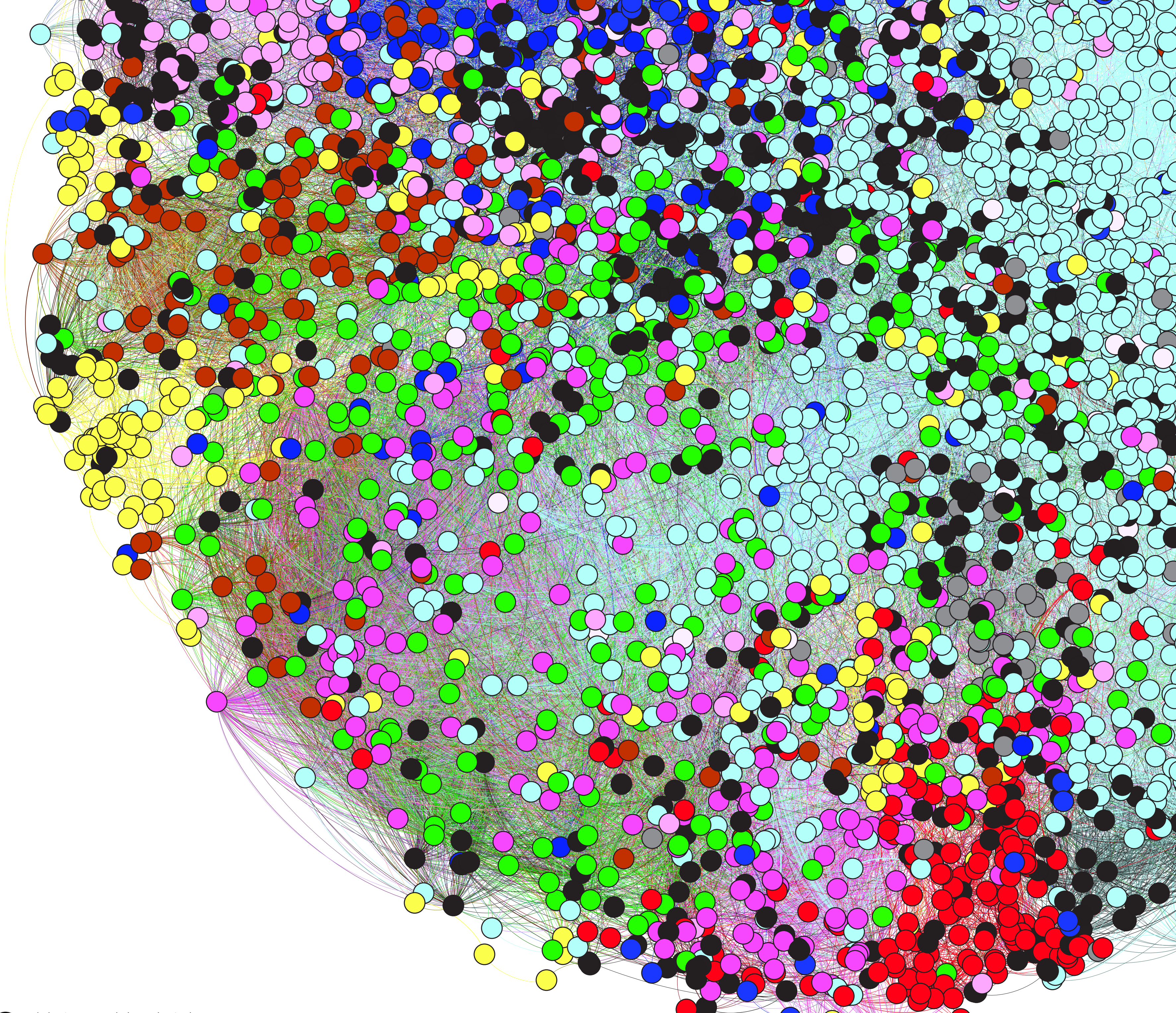
“If we know something about disease A, but not about disease B, phenotypic similarity between the two suggests they may result from a mutation or disturbance of genes or processes with a common pathway, and points to new investigations into disease B,” Hoehndorf said.

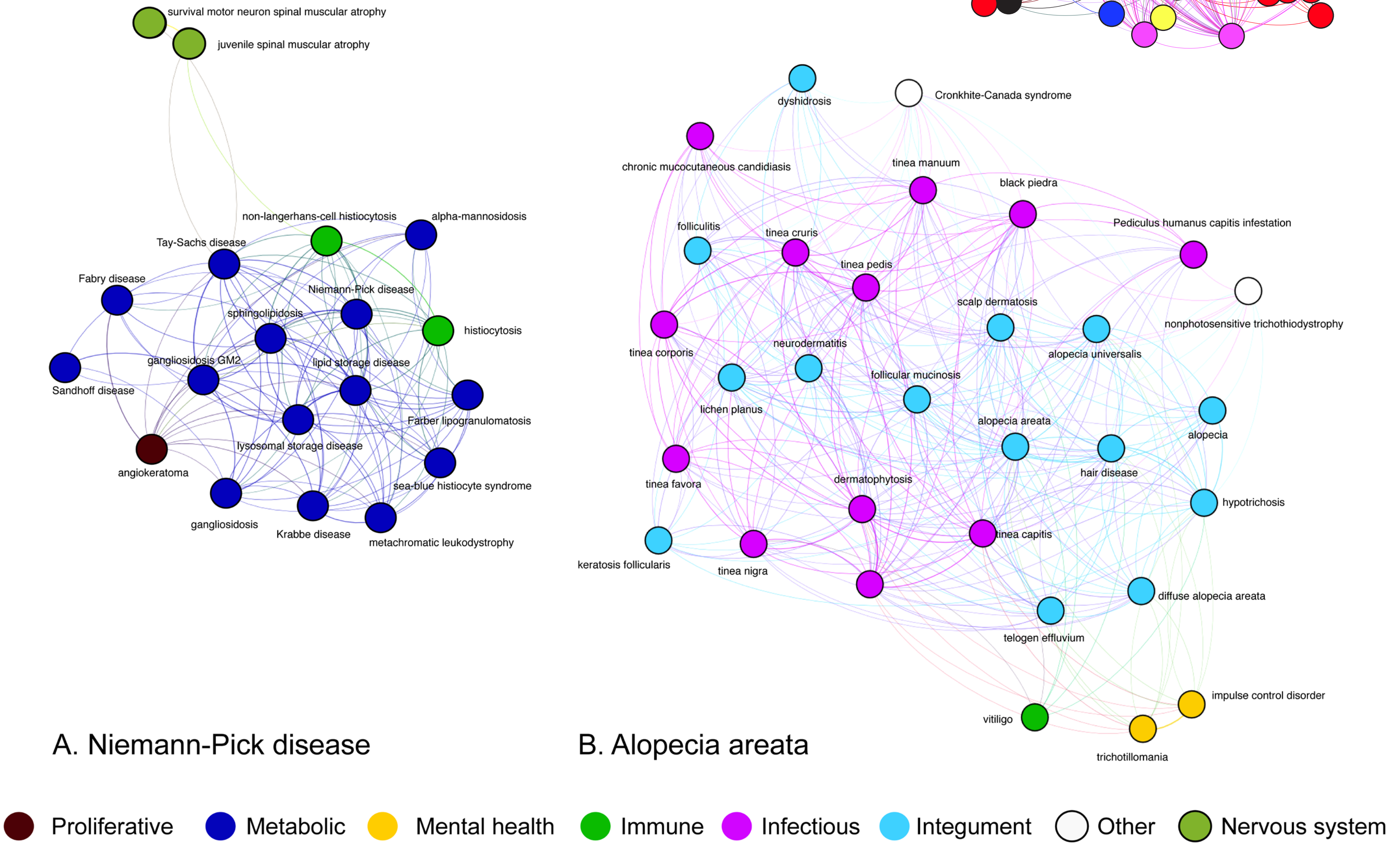
> “Our work gives us insight into disease processes and potential new therapies on a scale that would not have previously been possible.”

The researchers’ work will allow other scientists to formulate new hypotheses about poorly understood diseases through their phenotypic similarity to others that are better characterized, or those having well-established genetic underpinnings.

“Our resource can also be used to help in the prioritization of candidate genes in genome-wide and phenome-wide association studies, which is currently a major challenge, and aid in the development and repurposing of drugs,” Schofield said.

“We now have the semantic technologies and computational power to capture, manipulate and analyze large, complex biomedical datasets across a wide range of domains and data sources,” said Hoehndorf. “Our work gives us insight into disease processes and potential new therapies on a scale that would not have previously been possible.” ●





A. Niemann-Pick disease

B. Alopecia areata

Caption for the large image: A map of the human diseasome in which nodes represent diseases and colors are based on general types of diseases - cyan: disease of cellular proliferation; blue: nervous system and mental disease; red: cardiovascular disease; yellow: metabolic disease; green: infectious disease; magenta: immune system disease; brown: integumentary disease; pink: musculoskeletal disease; gray: urinary system disease. Proximity between the signs and symptoms of the diseases is used as an attraction force between the nodes so that diseases that appear close together in the map generally have similar signs and symptoms.

Caption for the small image - bottom: A part of the human diseasome focused on Niemann-Pick disease and Alopecia areata. Particularly striking is the inclusion of two forms of spinal muscular atrophy in the focus on Niemann-Pick disease, as the relation between lysosomal storage disorders (such as Niemann-Pick disease) and neurogenic muscular atrophy has only recently been investigated.

KAUST glides into **the future of oceanography**

By David Murphy

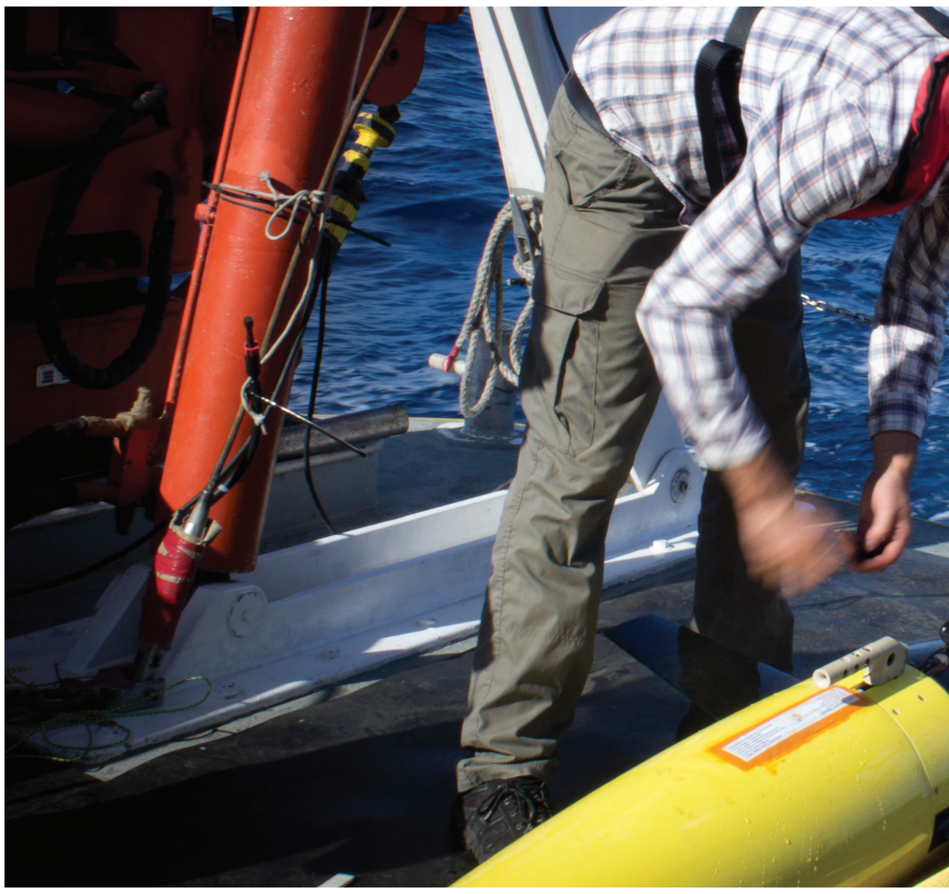
In the past, researchers only had access to occasional observational snapshots of the Red Sea. To form these snapshots, researchers had to spend weeks at a time at sea to laboriously capture data points by hand. With the advent of autonomous platform devices—including gliders and profiling floats—marine researchers are now able to capture the annual variability of physical and biogeochemical processes in real time.

"When I came to KAUST, it was clear that the most efficient way to gain an understanding about the Red Sea was to use vehicles that can maintain a sustained presence in the sea," said Burton Jones, KAUST professor of marine science. Jones heads up the KAUST/Aramco Red Sea glider program, which aims to understand the physics, biology and chemistry of the Red Sea.

A sustained presence

The principal goals in glider design are: endurance (specifically endurance which requires low power consumption and hydrodynamic efficiency), stability of sensors, efficient communications of data, stability and reliability of the components controlling the glider and fail-safe software that enables recovery of a glider when it encounters some sort of operational problem.

"The gliders can measure a number of variables and the exact configuration of the instruments, or sensors, on the glider will depend on what we want to accomplish," said Jones. "At the moment our gliders are configured to measure temperature, salinity, chlorophyll, which is an indication of the amount of photosynthesizing plankton, and concentration of dissolved organic matter. The applications of these near-term models are very important to an entity like Aramco, which funds much of our effort."

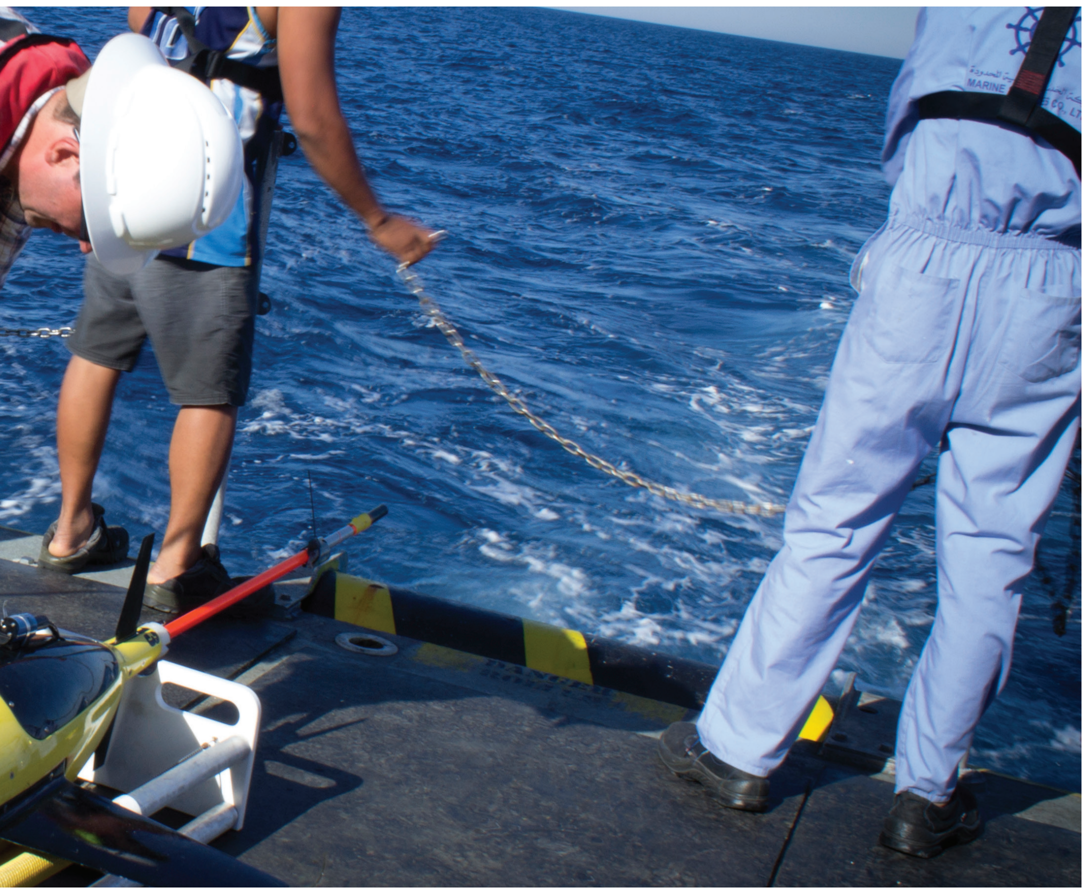


"We had a glider out for three months last winter; and one of the processes we were able to monitor was the formation of mesoscale eddies or gyres and anthropogenic inputs from the aqua-culture near the coast. The formation and decay of these eddies are very important to both the physics and biology of the Red Sea. When the ocean cools in the winter time, the water is able to mix much more deeply bringing nutrients up from below and that in turn causes biological productivity in the system. We were able to monitor these changes almost instantly," said Jones.

A global research tool

The gliders are deployed from a small boat offshore, while the piloting of the glider happens from the command center at KAUST under the guidance of Lloyd Smith, supervisor of marine electronics at the Coastal and Marine Resources

Researchers aboard the R/V Thuwal make repairs to one of their gliders before its deployment into the southern Red Sea.



Core Laboratory. The data is relayed back to researchers at KAUST via satellite communications whenever the vehicles surface, so they can observe the data in near-real time.

"I upload files to a server that the glider accesses via satellite. I enter a set of parameters such as 'quit' to stay at the surface, or 'resume', to dive. I give it a set of parameters such as how deep to dive, and for how long," said Smith. "Once the glider dives and it has its commands, it emails us updates on its projects. If something goes wrong, you just have to monitor your email. If it does not resurface by a time set by the parameters, then an alert system goes off."

"If a glider goes missing on us, we can map an area from the 'pings' we receive from the missing glider. We dip an acoustic ranging system, much like the blackbox on a plane; it replies to the acoustic signals and responds to give us a distance. We then do a number of tests to triangulate its actual location," said Smith.

"The funds that help build these models come from industry and government; with the goal of gaining a better understanding of our oceans. Data gathered from the gliders may be important to various decision makers whether it be scientists wanting to choose a time and place for specific measurements, or government agencies that need to make management decisions based on the available data. Either way both parties are better equipped to react in any given emergency situation like a shipwreck, oil spill, etc.," said Smith.

A better understanding

"There are a number of processes that are thought to be important to the functioning of the Red Sea," said Jones. "In order to fully understand the processes that contribute to and sustain the productivity and vitality of the coral reef ecosystems, we need to understand the interactions between these open-sea processes and the coastal reef ecosystems."

"Through our use of the gliders and their instrumentation we hope to gain a better understanding of how these processes interact with the reefs, and contribute to the productivity, connectivity, and fate of production from the reefs. The overall goal is to link all these processes together to understand how they combine to make the Red Sea what it is today," said Jones. ●

SRSI student wins on the global stage

Translated from an Arabic language article featured in Okaz.

Abduljabbar Al-Hamoud, a 2014 KAUST Saudi Research Science Institute (SRSI) participant, won two prestigious awards at the Intel International Science and Engineering Fair (Intel ISEF) 2015, held in Pittsburg, Pennsylvania, U.S. from May 10-15.

Intel ISEF is the largest international science competition for high school students from around the world. Each year, over 1,700 students exhibit their independent scientific research to a panel of doctoral scientists, competing for $5 million in prizes. Students are selected in a run-up of local, school-sponsored and regional science fairs, with the most talented going on to compete in Intel ISEF.

KAUST's SRSI program welcomes top Saudi high school students to the University's campus each year to conduct university-level research under the mentorship of KAUST faculty. SRSI introduces students to the transformative potential of science, technology, engineering and math, and inspires them to pursue further education and careers in these fields. It is also a gateway program to future studies at KAUST, aiming to develop the next generation of scientists, researchers and leaders for Saudi Arabia.

Big achievements

Al-Hamoud won the Intel ISEF 2015 Best of Category Award in Plant Sciences, a prize that came with winnings of $5,000. The prize was awarded for his research paper entitled "PLNT018I Efficient Viral-Mediated Genome Editing Technique In Tobacco nicotiana and Arabidopsis thaliana Model Plants Using CRISPR/Cas9." A $1,000 grant was also given to Al-Hamoud's high school and the Intel ISEF-affiliated science fair he represented.

In addition, Al-Hamoud won the Dudley R. Herschbach SIYSS Award, which includes an all-expenses paid trip to attend the Stockholm International Youth Science Seminar (SIYSS) in Sweden. During SIYSS, participants take part in seminars highlighting outstanding achievements by the world's young scientists, attend the Nobel Prize ceremonies and different lectures, visit scientific institutes and are involved in press conferences.

His best days

"Although I won two exciting awards, the real winner is my country," said Al-Hamoud. He stressed that he would not have won the awards without the considerable support he received during his time in KAUST's SRSI program.

"I chose KAUST specifically for the SRSI program," Al-Hamoud noted. "I was very happy to be among the high school students who were accepted to join SRSI in 2014. I consider the days I spent during that summer training at KAUST as some of the most important and wonderful of my life."

> Although I won two exciting awards, the real winner is my country,"

During his stay at KAUST, he was mentored by Magdy Mahfouz, Assistant Professor of Bioscience, Ph.D. student Aala Abulfaraj and postdoctoral fellow Dr. Zahir Ali.

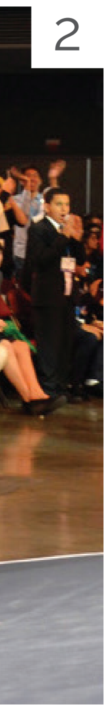
"When I arrived at KAUST, my knowledge about biology and genetic engineering was limited, but Dr. Abulfaraj explained everything to me in detail," he noted. "She was patient with me, as I had a lot of questions and she did her best to explain everything to me. In addition, Dr. Abdulfaraj kept encouraging me to study and said she saw much potential in me. During my short vacations, I continue to visit KAUST to study, train and conduct my research – these trips have been fully supported by Dr. Abdulfaraj and Dr. Mahfouz."

Learning to be successful

Al-Hamoud described his time at KAUST as "a very enriching experience that changed my habits and daily routine. Before attending KAUST, I did not know how a scientist spent his or her day or what it is like to be a university professor.

"Thanks to KAUST, I learned how to deal with bacteria and microorganisms you cannot see with the naked eye. I also took advantage of KAUST's advanced lab facilities for doing genetic engineering in plant science. Simply put, KAUST has taught me how to be successful." ●

1



2

الفائز بالمركز الأول في **جائزة** أنتل الدولية للعلوم

كشف الطالب عبدالجبار بن عبدالرزاق الحمود، الفائز بجائزة إنتل الدولية للعلوم والهندسة (Intel ISEF) و جائزة دودلي هرشباش لندوة الشباب الدولية للعلوم في ستوكهولم، أنه ليس هو الذي حقق هذه الجوائز "بل هو وطني المملكة العربية السعودية الذي حققتها، لأن هذه الجائزة هي باسم وطني قبل أن تكون باسمي".. وأكد الحمود في حديث خاص لـ "عكاظ" أن هذه الجوائز حققتها بدعم كبير من جامعة الملك عبدالله للعلوم والتقنية، فهي لم تقصر أبداً ودعمتني أثناء التدريب بكل شيء.

أجمل الأيام

ويتذكر الحمود قصة معرفته بجامعة الملك عبدالله للعلوم والتقنية، فيقول: الذي حدث أن ومؤسسة الملك عبدالعزيز لرعاية الموهوبين (موهبة) لديها برامج موهبة دولية ولها اختبارات محددة مثل اختبار موهبة قياس واختبار خاص باللغة الانجليزية وإذا تجاوزتها يتم ابتعاثك إلى الجهة التي يختارها الطالب وقد وقع اختياري على جامعة الملك عبدالله وتحديداً برنامجها الكبير لرعاية الموهوبين والجميل في هذه الجامعة أنها لا تقبل إلا الأكفاء ومن المعروف أن هناك تعاونًا وثيقًا بين جامعة الملك عبدالله للعلوم والتقنية ومؤسسة الملك عبدالعزيز لرعاية الموهوبين (موهبة). ويقول الحمود: لقد سعدت كثيراً بأن جامعة الملك عبدالله قبلت طلبي للتدريب فيها وكنتُ يومها ضمن 45 طالباً وطالبة تم قبولهم، وكانت مدة التدريب حوالي 7 أسابيع تعتبر بالنسبة لي أجمل وأفضل وأهم أيام حياتي التي عشتها وقضيتها في الصيف، حيث كانت تجربة تدريبية رائعة حقًا، وكان البروفيسور مجدي محفوظ والدكتوره آلاء ابو الفرج قد أشرفا عليّ طوال الوقت، وأنا أشكرهما عبر "عكاظ" شكراً جزيلاً خاصة د.آلاء التي بدأت معي من الصفر حيث كان مشروعي عن الجينات وكيف يمكننا أن نعمل هندسة جينية بطريقة آمنة.

ويذكر الطالب الموهوب أنه "عندما وصلت إلى جامعة الملك عبدالله كانت معلوماتي فقط عن الأحياء "هندسة جينات" لكن الدكتورة آلاء انطلقت معي من نقطة البداية إلى آخر المشروع وشرحته لي وأفهمتني إياه بالتفصيل الممل حيث جلست وصبرت معي كثيراً حيث لم أكن أعرف شيئاً وكانت ترحب بكل أسئلتي واستفساراتي دون كلل أو ملل أو امتعاض و كانت متجاوبة جداً وكانت ترى فيّ أملاً كبيراً كما كانت تقول لي وتشجعني حتى في الإجازات القصيرة كنتُ أطلب منها ومن البروفيسور محفوظ أن القدوم للجامعة لأتعلم وأتدرب وكانا يسمحان لي بكل سرور وقد وفرا لي عدداً من المختبرات المتقدمة في الجامعة لأعمل وأجري أعمالي وأبحاثي وتجاربي داخلها. وأحب مرة ثانية أن أقدم لهما شكري وامتناني العظيم على كل ما قدماه لي ومعهما د.زهير علي لأنهم تعبوا معي تعباً جباراً .

أجسام دقيقة

ووصف الحمود تجربته في جامعة الملك عبدالله بأنها "تجربة ثرية جداً غيرت من عاداتي وأطباعي، فعندما دخلتُ إلى جامعة الملك عبدالله لم أكن أعرف كيف يقضي العالم يومه؟ ولم أكن أعرف ما هو العمل الطبيعي للبروفسورات، لقد علموني كيف أتعامل مع كثير من البكتيريا ومع أجسام دقيقة لا ترى بالعين المجردة، وتعلمت كيف أستفيد من الخدمات وكيف أجعلها تضيف لتجاربي وأبحاثي.. ببساطة تعلمت من تجربة تدريبي في جامعة الملك عبدالله كيف أكون إنساناً ناجحاً. وأبدى الحمود تعلقه الكبير بعلماء جامعة الملك عبدالله مؤكداً أنهم مثله الأعلي وقدوته الحقيقية "إن تجربتي معهم أضافت لي الكثير حيث تعلمت كيف أدخل المعامل وكيف أجري فيها تجاربي وكيف أطبق الهندسة الجينية في علوم النبات.

جوائز الحمود

وكان الطالب عبدالجبار بن عبدالرزاق الحمود قد فاز بالمركز الأول في علوم النبات ضمن الطلبة السعوديين الذين شاركوا مؤخراً في مسابقة (إنتل آيسف ٢٠١٥) التي جرت في مدينة بتسبرج بولاية بنلسفانيا قبل أسبوعين، وحصد الحمود جائزة إنتل الدولية للعلوم والهندسة (Intel ISEF) بعد أن فاز بالمركز الأول في مجال علوم النبات حيث تبلغ قيمة الجائزة 5000 دولار، إضافة الى منحة بقيمة 1000 دولار إلى مدرسة الطالب ونسختها عن مسابقة إنتل الدولية للعلوم والهندسة.

كما نال الحمود جائزة أخرى هي جائزة دودلي هرشباش لندوة الشباب الدولية للعلوم في ستوكهولم (Dudley R. Herschbach SIYSS Award) وهي جائزة خاصة تخول الطالب الفائز للذهاب إلي السويد وحضور ندوات علمية متعددة التخصصات تهدف لإبراز بعض إنجازات العلماء الشباب المتميزين من جميع أنحاء العالم. كما تتيح للطالب الفرصة لزيارة المعاهد العلمية وحضور محاضرات لعلماء ومتحدثين بارزين من الحاصلين على جائزة نوبل ومؤتمراتهم الصحفية المرافقة، فضلاً عن الجولات السياحية في السويد للتعرف على تاريخها وثقافتها.

وكان البحث العلمي للطالب عبدالجبار هو:

PLNT018I: Efficient Viral-Mediated Genome Editing Technique In Tobacco noctiana and Arabidopsis thaliana Model Plants Using CRISPR/Cas9

ويتحدث عن تطوير تقنية جينومية فيروسية في النباتات. ●

1. Saudi Arabia was represented at the 2015 Intel International Science and Engineering Fair by a large group of male and female Saudi high school students.

2. Abduljabbar Al-Hamoud walks onto the stage at the Intel/ISEF 2015 Grand Award Ceremony to the delight of the many Saudi students, teachers and parents in attendance.

My University

Israa Al-Rowahi

Israa Al-Rowahi is Saudi, but was born in Cardiff, U.K. and returned to Saudi Arabia when she was 6-years-old. She completed her master's degree in biotechnology at Arabian Gulf University in Bahrain before coming to KAUST in 2012 as a doctoral student. Her Ph.D. advisor is Jörg Eppinger, assistant professor of chemical science in the Physical Science and Engineering Division.

Al-Rowahi is engaged in some interesting work at KAUST. "My research focuses on carbon capture and conversion. We capture toxic and environmentally harmful CO2 gas and use it to make bioplastic known as polyhydroxyalkanoates, or PHAs," she explained.

In her spare time, Al-Rowahi loves to read, which led her to help establish a book club on campus. She also enjoys yoga and sketching.

When asked how she came to KAUST, Al-Rowahi said, "I was doing the thesis part of my master's degree at Saudi Aramco's R&DC department in 2010. While at Aramco, I met the first batch of students that were recruited to come to KAUST, and after hearing about the place, I became interested in studying here." ●

Where do you read The Beacon?

This month's submission comes to us from Seoul, South Korea, where Adel Alrefaie, Translator in KAUST's Communications Department, represented the University at the World Conference of Science Journalists 2015.

While in Seoul from June 8 to 12 for the event, Alrefaie took time out to wander through the Bongeunsa Buddhist temple located in Samseong-dong, Gangnam-Gu. Founded in 794 B.C., the temple sits adjacent to Coex, South Korea's largest underground shopping mall. The temple's grounds feature a cluster of old Pinus koraiensis, or Korean pine trees, a bell that dates to the 14th century and a number of ceremonial halls.

Thanks to Mr. Alrefaie for the photo. If you'd like to be featured in upcoming issues, take a photo wherever you read The Beacon and send it to the editor at TheBeacon@kaust.edu.sa ●

The المنارة Beacon
تأمين مستقبل الطاقة في المملكة
Securing the Kingdom's energy future

Making a difference for schoolchildren in Thuwal

The Fourth Annual Thuwal & Qadimah School Kit Campaign is underway. Since its launch in 2012, the campaign has provided 1,700 children with essential school supplies, including backpacks, pens, pencils, calculators, notepads and more.

While the fundraiser may seem like a small gesture, the impact of the annual program is significant. The gift of school supplies helps ensure that children have what they need to learn, and it helps local families shoulder the burden of rising educational costs. It's also worth mentioning that, for most of the local schoolchildren, the program has become a highlight of the new school year.

Since the program's inception, KAUST volunteers have played a key role in making it a success, from promoting the campaign to packing bags and visiting schools to hand out the kits. This year, we're hoping to reach every grade K-12 student in Thuwal and Qadimah, an effort which will require 2,000 school kits—an ambitious but important goal.

We thank those who have contributed so far to this year's campaign, and we encourage community members to purchase vouchers from the on-campus Tamimi Markets, the Campus Diner and Matjar. Each voucher purchased will be matched by the University and puts the campaign one step closer to the goal.

The Thuwal & Qadimah School Kit Campaign is administered by Saudi Initiatives' Social Responsibility Department and is supported by KAUST volunteers and community members. ●